Jan. 15. Venus. Illuminated portion of disc = 0·902, Mars = 0·949.
17. 21h. Jupiter in conjunction with moon. Jupiter 2° 13′ S.
18. 2h. Venus in conjunction with moon. Venus 2° 12′ S.
18. 16h. Saturn in conjunction with moon. Saturn 2° 41′ S.
19. 18h. 37m. to 21h. 21m. Transit of Jupiter's Sat. III.
24. 8h. Venus in conjunction with Saturn. Venus 0° 20′ S.
28. 8h. 3m. to 8h. 28m. Moon occults 13 Tauri (mag. 5·4).
29. 6h. 0m. to 6h. 37m. Moon occults DM+20°, 785 (mag. 5·8).
30. 14h. 41m. to 15h. 36m. Moon occults χ^1 Orionis (mag. 4·7).

EPHEMERIS FOR OBSERVATIONS OF EROS.—The following is an abridgment of Herr Millosevich's ephemeris for January:—

Ephemeris for 12*h. Berlin Mean Time.*

1901.	R.A. h.	m.	s.	Decl. °	′	″	Mag.
Jan. 1	2	3	52·80	+37	55	14·5	
3		9	2·80	37	3	39·5	8·44
5		14	27·17	36	12	7·3	
7		20	4·92	35	20	39·0	8·45
9		25	55·21	34	29	15·8	
11		31	57·23	33	37	59·2	8·45
13		38	10·17	32	46	50·5	
15		44	33·19	31	55	51·2	8·46
17		51	5·61	31	5	3·0	
19	2	57	46·65	30	14	27·1	8·47
21	3	4	35·62	29	24	5·4	
23		11	31·79	28	33	59·3	8·49
25		18	34·34	27	44	10·1	
27		25	42·53	26	54	39·0	8·52
29		32	55·50	26	5	26·8	
31	3	40	12·48	+25	16	34·8	8·55

DIAMETER OF VENUS.—In the *Astronomische Nachrichten* (Bd. 154, No. 3676) Prof. T. J. J. See announces the results of a long series of measurements of the diameter of Venus, made with the filar-micrometer on the 26-inch refractor of the U.S. Naval Observatory at Washington. He also prefaces his remarks by a *résumé* of the observations of the diameter which have been made since the time of Galileo (1620).

The difficulties of the determination are summarised thus:—

(1) The enormous change in the geocentric distance of the planet renders the apparent diameter extremely variable.

(2) The thin line-like horns presented when the planet is near inferior conjunction are easily affected by atmospheric disturbances, rendering bisection with the micrometer wire difficult.

(3) As the crescent enlarges the diameter decreases.

(4) Near superior conjunction, although the disc is nearly round, its diameter is so small, and the time of observation is necessarily such that the heated atmosphere has a great disturbing effect on the definition.

(6) Irradiation, which is always great on account of the brilliancy of the planet.

Much of the difficulty due to the brilliancy has been eliminated by the use of coloured screens between the eye and telescope, as described in *A.N.* Nos. 3636, 3665.

The mean of Prof. See's determinations on 22 days gives a mean diameter of

$$16''{\cdot}80^{0} \pm 0''{\cdot}022$$

which is in close agreement with the value 16·820 deduced by Dr. Auwers in 1894 from the transits of Venus in 1874 and 1882.

Several suggestions are included comparing the work with heliometer and filar micrometer on planetary diameters, the two giving variable results with different planets.

REDUCTION OF OCCULTATIONS.—M. L. Cruls, director of the Observatory of Rio Janeiro, has published an improved method of time determination from lunar occultations, based on the exact knowledge of the instant of apparent conjunction of the two bodies. The formulæ of Bessel are slightly modified, and both analytical and graphical solutions given at length, with examples of each.

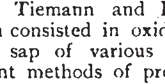
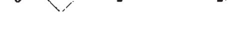
NATURAL AND ARTIFICIAL PERFUMES.

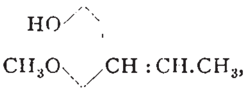
THE passing century has seen the rise and subsequent decay of several great branches of chemical industry. Early in the century, when the chemical methods applicable to the manufacture of alkalis and of alkali products were being actively developed, profits were large, whilst now that the chemical difficulties encountered in the manufacture of alkali have been practically overcome, the financial prosperity of an alkali works depends mainly upon economy in carrying out certain engineering processes; the science of the chemist is now of rather less importance than the art of the engineer. The younger industry of coal-tar dye-stuff manufacture is similarly, though more gradually, developing into a branch of engineering, and in consequence money is not made so rapidly as was once the case. During the last twenty-five years a new chemical industry, that concerned with artificial perfumes, has made rapid progress and would seem to give more promise of both chemical and financial prosperity than either of its elder sisters. Perfumes are only needed in small quantities, but, in accordance with the law that anything ministering to our pleasures fetches a far higher price than a mere article of utility, profits upon a really gigantic scale may be easily obtained; again, the enduring chemical prosperity of the new industry is assured in that a constant succession of new perfumes is absolutely necessary; by the time that improved methods of manufacture and competing processes have lowered the price of a perfume, the material has become unfashionable. No lady would use a cheap perfume. Further, the sense of smell in man is as yet wholly uncultured; in walking through the country we can rarely identify a particular odour caught until the sight of the plant from which it emanates makes us wonder at our hesitation. The coal-tar colour industry found us provided with a highly-developed system of colour perception, whilst the newly-inaugurated artificial perfume industry has to cultivate a neglected sense probably possessing similar artistic potentialities.

The scientific methods adopted in the new industry consist, in the main, of three: (1) in the extraction of odoriferous compounds from the natural products in which they occur; (2) in the artificial preparation of naturally occurring odoriferous compounds by synthetic processes; and (3) in the manufacture of materials possessing odours resembling those of naturally occurring substances of pleasant smell. The odoriferous principle of bitter almond oil was one of the first isolated and subsequently synthesised; the oil was obtained during the Middle Ages by distilling bitter almonds with water, whilst, nowadays, only very small quantities are prepared from the almond. Apricot kernels are first freed from fatty oils by hydraulic pressure, and then caused to undergo a fermentative process. The kernels contain a glucoside, amygdalin, which, at a suitable temperature, is hydrolysed by an unorganised ferment, emulsin, also present, with formation of benzaldehyde, $C_6H_5.CHO$, hydrogen cyanide and grape sugar, in accordance with the equation

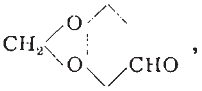
$$C_{20}H_{27}NO_{11} + 2H_2O = C_6H_5.CHO + 2C_6H_{12}O_6 + HCN.$$

The mass is then distilled in a current of steam, and the resulting oil separated from the aqueous distillate and freed from the prussic acid which it still retains. Liebig and Woehler first separated pure benzaldehyde from crude bitter almond oil in 1832. Benzaldehyde is prepared on a large scale by the hydrolysis and oxidation of benzyl chloride by boiling it with cupric or lead chloride solution; the artificial oil retains with great tenacity traces of benzyl chloride, and the penetrating, unpleasant odour of this impurity renders the product fit only for scenting common soaps and prevents its use in perfumery. Nitrobenzene, $C_6H_5.NO_2$, the highly poisonous so-called oil of mirbane, has an odour very similar to that of benzaldehyde, and is sometimes used in its place.

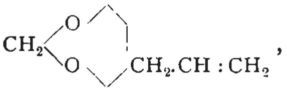
Vanillin, the odoriferous principle of the vanilla bean, is an aldehyde of the constitution , and was artificially prepared in 1874 by Tiemann and Haarmann; the original method of preparation consisted in oxidising coniferin, a glucoside contained in the sap of various coniferæ, with chromic acid. Many different methods of preparing vanillin have been patented; but it seems now to be mainly obtained from eugenol,  a phenol contained to the extent of 70 to 90 per cent. in oil of cloves; this is heated with alkali, which converts it into isoeugenol

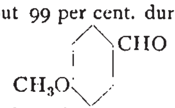
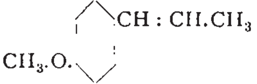
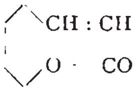


and the latter is then oxidised to vanillin. Synthetic vanillin has practically displaced the vanilla bean for use in perfumery and the manufacture of confectionery, and, in spite of frequent adulteration with sugar, acetanilide and other comparatively valueless materials, the price of the genuine synthetic article is now only a little more than 1 per cent. of that obtained in 1876. The nearly related aldehyde, piperonal,



which has a very powerful odour resembling that of the heliotrope, and is consequently used in perfumery under the name of "heliotropin," is largely prepared from safrole



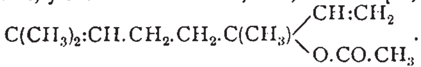
a methylenic ether contained in oil of sassafras and oil of camphor; its price has dropped by about 99 per cent. during the last twenty years. Anisic aldehyde, , which has an intense odour resembling that of the hawthorn flower, was greatly in use some four or five years ago; it is prepared from anethol, , the ether constituting 80 or 90 per cent. of oil of anise. Coumarin, orthohydroxycinnamic anhydride, , is the material to which the tonka bean, sweet woodruff and new-mown hay owe their characteristic odours; it was synthetically prepared by W. H. Perkin, sen., in 1868, by heating sodiosalicylic aldehyde with acetic anhydride, and was obtained commercially by this method until its recent discovery in considerable quantities in *Liatris odoratissima*, a herb indigenous to Florida, provided a cheaper method of preparation. The pleasant smell of cassia oil is due to its containing from 75 to 90 per cent. of cinnamic aldehyde, $C_6H_5.CH : CH.CHO$, which was first synthesised by Strecker; the aldehyde is readily obtained by condensing benzaldehyde with acetaldehyde in presence of soda, and has, indeed, been commercially obtained by this method at times when the Chinese cassia oil distillers adulterated the oil to too great an extent with petroleum, resin, &c.

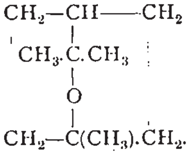
The greater number of the ethereal oils prized in perfumery owe their pleasant odours, not to one constituent alone, but to several, and the smell of the more valuable, such as lavender oil, rose oil, Ylang-Ylang, &c., is a blend of the odours of a number of odoriferous components; the determination of these constituents and their preparation in a state of purity with a view to an ultimate successful imitation of particular ethereal oils has long constituted one of the most intricate problems of industrial chemistry, one, however, which has been attacked with astonishing success. A few of the more important odoriferous principles may be briefly discussed. The aldehyde citral or geranial, $C(CH_3)_2{:}CH.CH_2.CH_2.C(CH_3){:}CH.CHO$, constitutes about 6 per cent. of oil of lemons and about 80 per cent. of lemongrass oil, and gives to these oils their lemon-like odour; it is largely prepared, commercially, from lemongrass oil, and is accompanied in nature by its dihydro-derivative, citronellal, $C(CH_3)_2{:}CH.CH_2.CH_2.CH(CH_3).CH_2.CHO$. Citral was synthesised from acetoacetic ether by Tiemann in 1898, and is converted by reduction into the alcohol, geraniol,

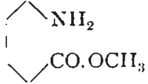
$$C(CH_3)_2{:}CH.CH_2.CH_2.C(CH_3){:}CH.CH_2.OH.$$

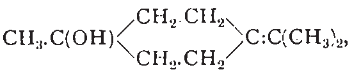
Similarly, citronellal yields on reduction the corresponding alcohol, citronellol,

$$C(CH_3)_2{:}CH.CH_2.CH_2.CH(CH_3).CH_2.CH_2.OH;$$

geraniol, further, can be converted into an isomeric alcohol, linalool, $C(CH_3)_2{:}CH.CH_2\,CH_2.C(CH_3)(OH).CH{:}CH_2$, by heating with water. These three alcohols, geraniol, citronellol and linalool, yield esters with acids, such, for example, as linalyl acetate,  $C(CH_3)_2{:}CH.CH_2.CH_2.C(CH_3)\left\langle\begin{matrix}CH{:}CH_2\\O.CO.CH_3\end{matrix}\right.$. These aldehydes and alcohols, together with a number of the esters formed with fatty acids, occur in many ethereal oils. French oil of lavender is distilled from wild lavender in the hills of southern France, and contains 30 to 40 per cent. of linalyl acetate and about an equal quantity of linalool and small quantities of geraniol; English oil of lavender is distilled from the cultivated plant, and contains only 5 to 10 per cent. of linalyl acetate, but considerable amounts of cineol,

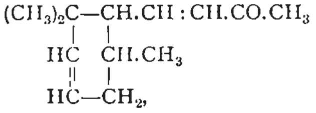


The fact that English oil fetches about ten times the price of the best French oil is a frequent source of unfavourable comment by Continental merchants. Ylang-Ylang oil contains linalool and geraniol, and apparently also the acetic and benzoic esters of both alcohols; the similar, though less valuable, Cananga oil contains smaller quantities of the esters and larger quantities of a sesquiterpene, $C_{15}H_{24}$. Otto of roses, which has for centuries been the most highly prized of all perfume oils, is obtained in the East, in Bulgaria, Germany and, to a small extent, in France, by distilling freshly-gathered roses with water; it contains a wax-like hydrocarbon, the so-called stereoptene, and during the last month Walbaum and Stephan have shown that German rose oil owes its odour to geraniol, citral, citronellol, linalool, nonylic aldehyde, $C_9H_{19}.CHO$, and phenylethylic alcohol, $C_6H_5.CH_2.CH_2.OH$. It is interesting to note that Neroli oil, which contains linalool, geraniol and linalyl acetate, owes its odour in part to the presence of a small percentage of methyl anthranilate, ; this substance, in an undiluted condition, has a somewhat unpleasant odour, but when highly diluted smells very much like oil of bitter orange. An alcohol termed terpineol,



is found in many essential oils, and is readily and cheaply prepared by the action of dehydrating agents upon terpin hydrate, which in turn is easily prepared from turpentine oil; terpineol has a powerful odour of lilac, and consequently finds extensive application as a basis in the manufacture of perfumes.

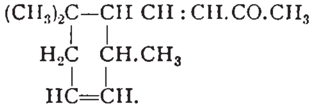
Oil of orris, mainly obtained from Italian orris root, consists, to the extent of about 35 per cent., of the odourless myristic acid. In 1893 Tiemann and Krueger showed that the odour of fresh violets possessed by the oil is due to the presence of a small proportion of a ketone to which they gave the name irone; as the result of an important piece of experimental work, they proved that irone has the constitution



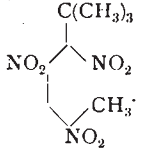
and a patent was obtained by Haarmann and Reimer for a method of separating this ketone from oil of orris. Tiemann and Krueger, before actually ascertaining the constitution of irone, conceiving the possibility of preparing a substance of the same molecular composition as irone from citral, endeavoured to do so in order to obtain information as to the constitution of the ketone. They found that, on allowing a mixture of citral and acetone to remain in contact with baryta solution, an ordinary acetone condensation slowly occurs with formation of a ketone, the so-called pseudoionone, having the constitution

$CH(CH_3)_2.CH_2.CH : CH.C(CH_3) : CH.CH : CH.CO.CH_3$.

Pseudoionone has a peculiar but not very pronounced smell, and, when heated with a mixture of water, glycerol and sulphuric acid, undergoes conversion into an isomeric ketone, termed ionone, which possesses the constitution



Ionone possesses an odour of fresh violets, which also feebly recalls that of grape blossom; it is manufactured on a large scale for use in the preparation of violet perfumes. The preparation of homologues of ionone from citral and methylethylketone has also been protected, and numerous attempts to evade the original patents have naturally been made; the use of lemongrass oil in place of citral, and of bleaching powder as a condensing agent in place of baryta, have been patented, but these patents have not been upheld by the Courts. It is a very remarkable fact that the two ketones, irone and ionone, possess odours so similar that, either when pure or diluted with alcohol, a trained nose is only just able to distinguish between them. The similarity in odour is doubtless due to the almost identical type of molecular grouping contained in the two compounds. Oil of turpentine consists essentially of a hydrocarbon of similar molecular type to irone and ionone, and it is a very noteworthy fact that turpentine, when administered internally, imparts a strong odour of violets to the urine; so far as can be ascertained, this fact has received no commercial application.

A number of substances have been introduced into commerce as substitutes for musk; of these, the first was the trinitroisobutyltoluene of the constitution  It is obtained by nitrating isobutyltoluene, which is, in turn, prepared by the interaction of isobutyl chloride and toluene brought about by aluminium chloride. This and other trinitro-derivatives of benzenoid hydrocarbons containing two alkyl groups in the meta-position possess a powerful odour of musk, and have been used to a considerable extent in perfumery.

The investigation and manufacture of artificial and synthetic perfume materials have been only carried on to a very small extent in this country; the new industry is almost wholly of German origin. During recent years, however, France appears to have been making great strides in synthetic perfume manufacture, and at the Paris exhibition this branch of chemical manufacture seems to be the only one in which the French exhibits equal, or even excel, those of Germany. The cause of this is obscure, but may possibly be connected with the generally recognised principle that supremacy in any particular industry goes hand in hand with supremacy in the related sciences; and all students of contemporary chemical literature will agree that in Germany the science of chemistry has been in rapid decadence during recent years. A good organisation, administered by a master, accomplishes great results; but when the directing hand is gone, the very organisation itself is found to have stultified the faculty for independent thought on the part of those originally destined by nature to take the lead. Subsequently the system aids only in the filling up of immaterial details, and the pioneer work is transferred to men from quite a different school.

Little has yet been accomplished towards ascertaining the relation between the odour and the chemical constitution of substances in general. Hydrocarbons as a class possess considerable similarity in odour, so also do the organic sulphides and, to a much smaller extent, the ketones. The subject waits for some one to correlate its various physiological, psychological and physical aspects in the same way that Helmholtz did for sound. It seems, as yet, impossible to assign any probable reason to the fact that many substances have a pleasant odour. It may, however, be worth suggesting that certain compounds, such as the volatile sulphides and the indoles, have very unpleasant odours because they are normal constituents of mammalian excreta and of putrefied animal products; the repulsive odours may be simply necessary results of evolutionary processes. W. J. P.

PRIZE LIST OF THE ACADEMY OF SCIENCES.

At the annual public meeting of the Paris Academy of Sciences, on December 17, after the Presidential Address of M. Maurice Lévy, in which was a short account of the life work of MM. Milne-Edwards, Bertrand, Blanchard and Grimaux, the list of awards for the year 1900 was given.

In Geometry, the Grand Prize of the Mathematical Sciences was awarded to M. Mathias Lerch for work on the number of certain classes of quadratic forms; the Francœur Prize to M. Edmond Maillet, and the Poncelet Prize to M. Léon Lecornu. No memoir was received complying with the terms of the Bordin Prize. In Mechanics, the Extraordinary Prize of 6000 francs was divided between MM. Laubeuf, Charbonnier, Aubusson de Cavarlay and Grasset, M. Lerosey receiving the Montyon Prize, and Mme. Moissenet the Plumey Prize as a mark of esteem for the work done by her late husband.

In Astronomy, the Lalande Prize was adjudged to M. Giacobini for his work on comets; the Damoiseau Prize to M. J. von Hepperger for his work on the influence of the planets upon comets: the Valz Prize to M. l'Abbé Verschaffel for work done at the Abbadia Observatory; the Janssen Prize to Prof. Barnard for his brilliant discovery of the fifth satellite of Jupiter.

In Statistics, the Montyon Prize has been awarded to M. du Maroussem, the works of M. Barras, M. Laussedat and M. Pailhas receiving honourable mention.

In Chemistry, M. Béhal receives the Jecker Prize, and in Botany, M. H. Bruchmann the Desmazières Prize, M. Gyula Istvanfi having a very honourable mention. The Montagne Prize is divided between MM. Delacroix and Boistel. In Anatomy and Zoology the Thore Prize is awarded to M. Seurat for his researches on the parasitical larvæ of the Hymenoptera, and the Da Gamo Machado Prize to Mme. la Comtesse de Linden, M. Siedlecki, M. P. Carnot and M. Bordas, the Savigny Prize not being awarded.

In Medicine and Surgery, Montyon Prizes are adjudged to MM. Hallopeau and Leredde, for their treatise on dermatology; M. Guilleminot, for his work on the medical applications of the X-rays; and M. Joules Soury, for his book on the central nervous system. In connection with these prizes, mentions are accorded to M. Nobécourt, for his work on the pathogeny of the gastro-intestinal diseases of young children; M. Sabrazès, for his work on the origin of blood corpuscles; and M. Gallois, for a book on scrofula and odenoidal diseases; MM. Cunéo and Toulouse receiving citations. The Barbier Prize is divided between M. Marage, for a memoir on the theory of vowel formation, and M. Guinard, for a pharmacodynamic study of morphine and apomorphine, a mention being accorded to MM. Bræmer and Suis. In default of the discovery of an absolute specific for cholera, the arrears of interest on the Bréant Prize are divided between M. Auclair, for researches on the toxic substances contained in tubercle bacilli, and M. Paul Remlinger, for a memoir on some rare complications of dysentery, and the association of dysentery with typhoid fever. The Godard Prize is given to M. Léon Bernard, for his researches on the functions of the kidney in chronic nephritis; the Parkin Prize to M. Henri Coupin, for work done in plant physiology; the Dusgate Prize to M. Icard, for methods of diagnosis of real and apparent death; the Baron Larrey Prize to MM. Nimier and Laval, for three works on projectiles and explosives; the Bellion Prize being divided between M. J. Brault, for his treatise on tropical diseases, and M. Samuel Gache, for his treatise on workmen's dwellings in Buenos Ayres; the Lallemand Prize between M. Maurice de Fleury, for various treatises on medicine, and M. de Vabias, for his researches on the nervous system of aquatic gasteropods. Honourable mentions are accorded to MM. Knopf, Jacquet and M. Finck.

In Physiology the Montyon Prize is divided between M. Pachon for studies on cardiac and vascular mechanism and Mdlle. Jotéyko for memoirs on nervous effort and fatigue, and the Philipeaux Prize between M. Delezenne for his reseaches on anti-coagulating substances and M. Nicloux for experimental researches on the elimination of alcohol in the organism, M. Roussy receiving honourable mention; the Pourat Prize is awarded to MM. Bergonié and Sigalas for a determination of the principal anthropometric data; and the Martin-Damourette Prize to M. Long for his studies on the central paths of general sensibility. In Physical Geography, M. Lugeon receives the Gay Prize for his theory on the origin of Alpine valleys.

Among the General Prizes, a Montyon Prize is awarded to